

## ABSTRACT

**[C39]** A method and system of inertia friction welding of work parts welded with a specified angular orientation with respect to each other. The method and apparatus comprises loading a sample work part into a rotating chuck attached to a spindle and loading another sample work part into a non-rotating chuck and then applying torque to the spindle to accelerate the spindle to achieve a predetermined first rotational speed. Next, the sample work parts are inertia friction welded together to form a sample weld. Then, the system measures and stores data related to the deceleration of the spindle during the sample inertia friction weld. The welded sample work parts are removed from the rotating and the non-rotating chucks. The system then calculates a sample deceleration profile of the spindle from the data acquired during the formation of the sample weld. Next, a production work part is loaded into the rotating chuck and another production work part is loaded into the non-rotating chuck. The system applies torque to the spindle to accelerate the spindle to the predetermined first rotational speed which is maintained a rotary position of the spindle matches a calculated value. The system then inertia friction welds together the production work parts to form a production weld. During the formation of the production weld, the system controls torque applied to the spindle during the inertia friction welding of the production work parts so that the spindle deceleration during the formation of the production weld matches the sample deceleration profile of the spindle during the formation of the sample weld and so that the production weld ends in the specified angular orientation of the work parts with respect to each other.